DOCUMENT RESUME

ED 433 359 TM 030 048

AUTHOR Hecht, Jeffrey B.
TITLE Using a PDA for Field Data Collection.
PUB DATE 1997-10-17
NOTE 12p.; Paper presented at the Annual Meeting of the Mid-Western Educational Research Association (Chicago, IL, October 1997).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150) -- Tests/Questionnaires (160)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Oriented Programs; Data Analysis; *Data Collection; *Field Studies; *Graduate Students; Graduate Study; Higher Education; *Research Methodology; Social Science Research
IDENTIFIERS *Personal Digital Assistants

ABSTRACT

Personal Digital Assistants (PDAs) allow users a small profile, battery-operated, and relatively low-cost way to take many of the capabilities of a personal computer into the field. This combination of features suggests a great potential for the use of a PDA as a field data collection instrument. This research compared the use of one kind of PDA (the Pilot by U.S. Robotics) for this purpose. Seventy-five participants took part in a study comparing the usefulness of a paper-and-pencil data collection strategy, an optical mark recognition (OMR) form, and the use of a PDA. Results show that the paper-and-pencil method was the easiest and fastest to set up and get into the field, while the PDA method proved the fastest and most accurate for transferring collected data into a computer for later analysis. These results show that a PDA can be a useful tool for certain kinds of field-based social science research. An appendix contains the survey of attitudes about statistics used for data collection. (Contains 14 references.) (Author/SLD)

**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

IR



Running head: USING A PDA FOR FIELD DATA COLLECTION

ED 433 359

# Using a PDA for Field Data Collection

Jeffrey B. Hecht

The Technological Innovations in Educational Research Laboratory
Department of Educational Administration and Foundations
Illinois State University
Normal, IL 61790-5900

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Jeffrey Hecht

TM030048

A Paper presented at the 1997 Annual Meeting
of the
Mid-Western Educational Research Assocation
Chicago, IL
October 17, 1997



BEST COPY AVAILABLE

Abstract

Personal Digital Assistants (PDAs) allow users a small profile, battery-operated, and relatively low cost way to take many of the capabilities of a personal computer into the field. This combination of features suggests a great potential for the use of a PDA as a field data collection instrument. This research compared the use of one kind of PDA (the Pilot by U.S. Robotics) for this purpose. Seventy-five participants took place in a study comparing the utility of a paper-and-pencil data collection strategy, an optical mark recognition (OMR) form, and the use of a PDA. Results show that the paper-and-pencil method was the easiest and fastest to set-up and get into the field, while the PDA method proved the fastest and most accurate for transferring collected data into a computer for later analysis. These results show that a PDA can be a useful tool for certain kinds of field-based, social science research.

# Using a PDA for Field Data Collection

New technologies have created an explosion in the number and kinds of computing devices. The most recent addition to the cornucopia of smaller and faster techno-wizardry is the Personal Digital Assistant, or PDA. Originally conceived of as just an electronic version of the pocket-sized, pen-and-paper date book, the latest devices boast features and capabilities not found on even the most advanced desktop computer systems. The best of these PDAs are small in size yet with large storage capacities, able to reliably recognize handwritten words (eliminating the need for bulky keyboards and mice), and with the ability to be quickly and easily synchronized with desktop computer databases.

It would not be unusual, given these capabilities, for social science researchers to imagine these new PDAs as a potential new tool for data collection. PDA-based software does exist for this purpose, suggesting that development companies have been thinking along these lines. How well the use of a PDA compares to more traditional field-based methods remains unknown. The purpose of this study, therefore, is to investigate the potential utility of a PDA for field data collection, and to compare it to more traditional data gathering strategies.

## The PDA

There is nothing new about using computer technology for data collection in field-based research. Small, handheld, general purpose computing devices have been in use since 1988 (Saudargas & Bunn, 1989). Research on these devices have shown their use to be as, if not more, effective than the use of other methods of data collection (Saudargas & Zanolli, 1990). More recent studies have expanded the notion of field-based research to include any activity when the researcher is away from his or her own office/laboratory, including wireless access to library based resources (Foster, 1995).

A combination of factors seem to be driving this expansion in the use of handheld computers for research. Decreased cost, increased functionality, and a reduced size are all hallmarks of the last in technological advances. The most recent addition to the handheld, or PDA, family carry as much computing power as functional capacity as an entry-level desktop computer yet typically occupy less space than a VHS videotape (Lasky & McCracken, 1997). Although a relatively new device, manufacturers have been quick to fill the market with competing models, offering a dizzying array of features over a wide range of prices (Davids, 1996a and 1996b; Thompson, 1996; Marshall, 1996)

One product that seems especially well suited to field research, due to its extreme small size and capable set of software, is U.S. Robotics' PalmPilot product (Wayner, 1996; U.S. Robotics, 1996). This PDA has been described by one reviewer as "... the smallest, easiest-to-carry palmtop we tested — it's about the size of a deck of playing cards and weighs less than 6 ounces, so it fits comfortably in my shirt pocket"

(Lasky & McCracken, 1997, p. 166). Powered by only two AAA batteries, the PalmPilot will run for two to three months of average daily usage before a battery change becomes necessary. Data loaded onto this device is easily transferred to a hosting computer by a "hot-link" cable and single button functionality (Byte Magazine, 1996). Recent upgrades to the Pilot PDA (Blodgett, 1997) provide a backlit screen, increased memory, expense tracking, and a modem with e-mail functionality.

One of the most impressive features of the Pilot PDA is its ability to accept downloaded software. A number of third-party software developers have begun creating applications for the Pilot, including Pendragon Software's PilotForms package. This program, occupying just over 75kb of memory on the Pilot (and approximately four to six megabytes on the accompanying personal computer) and costing under $50, provides user-programmable data entry and editing capabilities (Pendragon Software Corporation, 1997). Information entered into a PilotForms data entry screen on the Pilot is automatically transferred to a Microsoft Access database on the host personal computer when the unit is hot-linked.

Can this technology really improve upon more tried-and-true methods used for collecting data in the field. In this study I attempted to ascertain the utility of using a PDA like the Pilot for field data collection, as compared to more traditional methods like paper-and-pencil recording and the use of an optical mark recognition (OMR) form. If the added expense and learning/programming of the PDA is to have a true utility for field-based researchers it must be demonstrated that collecting data using a PDA has significant benefits over existing, lower cost techniques.

## Methods

### Participants

Seventy-five individuals from the campus community at a large, mid-western university volunteered to participate in the study. Subjects were chosen as a sample of convenience rather than for any determining characteristics. These 75 individuals were randomly distributed into three different groups of 25 persons each. One group received the survey using a paper-and-pencil methodology, another group using a optical mark recognition recording style, and the third using a PDA. In order not to bias the study participants were not told the true purpose of this research; rather, each was informed that the purpose of the study was to examine attitudes about research courses (the content of the questionnaire).

### Materials

Three different forms of the survey instrument, expanded from a work by Wise (1995, p. 403), were created for this research (Appendix A). The first form of the instrument was utilized in the paper-and-pencil methodology. Multiple copies of this form were created, and respondents answers were recorded directly onto the form by

the researcher. The second form of the instrument was used in the OMR methodology. One copy of the instrument was made, with the researcher recording respondents answers onto an OMR sheet placed adjacent to the questionnaire. The final form of the instrument was entered into a PilotForms database and uploaded to a Pilot PDA. Participant responses were recorded directly into the Pilot – no paper form was used.

Design and Procedure

Three research assistant, blind to the true purpose of the study, were employed for the actual field data collection. Each assistant was given one of the three methodologies, access to a personal computer, and necessary documentation (for the OCR and PDA methods). All three assistants were trained in the administration of the survey, and were urged to complete each interview as rapidly as possible while recording all responses and other comments made by each participant.

The field data collection proceeded in three distinct stages. In the first stage each assistant was to convert the survey items into a format appropriate for their methodology. In the case of the paper-and-pencil strategy this meant: typing the survey questions into a word processor, proofreading and printing the final survey, photocopying 25 duplicates of the survey, and locating a clipboard and pencils to use in the field. In the case of the OMR strategy this meant: typing the survey questions into a word processor (with item numbers for OMR form matching), proofreading and printing the final survey, acquiring blank OMR forms and blank paper (to record the open-ended responses and other comments), and setting up the OMR machine (a Scantron 8200) and software (Scantron's Scanbook program) to record the scanned forms. In the case of the PDA strategy this meant: setting up the PilotForms software on the personal computer, typing the survey items into this software, downloading the completed form to the Pilot PDA, and practicing with the PDA to insure proper operation.

The second stage involved the actual conduct of the survey with the participants. Twenty-five participants were randomly chosen for each methodology, for a total sample of 75 participants.

The third stage involved transferring the data from the collection format into the computer for further analysis. The desired outcome from this stage were two computer data files: an SPSS (version 7.5 for Windows) systems file containing the coded categorical and other numeric response items, and a text file containing the participant responses from the open-ended questions, in addition to any other comments given by the participants. For the paper-and-pencil methodology this stage involved typing each of the completed field forms into the appropriate software package, then checking each data entry for errors. The OMR strategy involved typing the textual responses into the computer, and using the Scantron 8200 to scan the coded responses. These scanned responses were automatically placed into delimited text file which was then imported into SPSS. The PDA methodology involved hot-linking the PDA to transfer the data

from the PDA into a Microsoft Access database on the personal computer. This file was then manipulated to export the coded data to SPSS and the textual data to a text file.

The research assistants recorded the total time for each stage of the process, in addition to their own thoughts about their data collection methodology. Assistants were debriefed at the end of the study, and their information collected and tabulated.

## Results

### Stage One Results

The paper-and-pencil strategy was the fastest and easiest to set up, taking only three-quarters of one hour to prepare. The OMR methodology required the next most amount of time, taking just over one-half hour to type the questionnaire and almost 75 minutes to program, test, and debug the Scantron 8200 for the actual scanning. The PDA strategy took the longest to set up, requiring almost four hours of time. Much of this time was spent experimenting with different software options, and learning how to use the PilotForms program. The assistant working on this strategy did acknowledge, however, that future surveys using the PDA could be set up quite quickly, perhaps even as fast as the paper-and-pencil method, now that the critical how to was accomplished.

### Stage Two Results

The mean interview time for all three methods was just over three minutes at 185 seconds. A one-way analysis of variance was used to test whether one method was significantly faster than another. No significant differences ($p > .05$) were found between the paper-and-pencil method ($M = 174$ seconds), the OMR method ($M = 201$ seconds), and the PDA method ($M = 180$ seconds).

### Stage Three Results

The PDA methodology was the fastest and easiest of the three methods when it came to transferring the data into the computer. The hot-link process took a total of 12 seconds, while formatting and exporting the data to the appropriate file formats took another four minutes. Since the PilotForms software will not produce a native SPSS file it was necessary to export the data first into an Excel spreadsheet file, then use SPSS to read this Excel file. An addition five minutes was spent spot-checking the final SPSS and text data files against the information stored in the PDA to insure accuracy. No errors were found in either the coded or textual data.

The OMR methodology was the next fastest. While it required about 25 minutes to type the open-ended responses into the computer using a word processor (Microsoft Word), the actual scanning of the OMR forms was accomplished in just over two minutes. The Scanbook software produces a delimited text file as output. This file had to then be imported into SPSS, a process which took another 11 minutes of typing field

definitions. In a few cases (6 forms out of the 25 total) there were one or more errors in the scanned data. These errors were corrected directly in the SPSS spreadsheet editor by comparing the original OMR form to the scanned information. In all cases these errors were due to either too light a marking, or marking outside of the bubble boundaries, on the OMR form. It was not necessary to spot-check the entered data, as incorrect form reads showed up as specific error values in the SPSS spreadsheet. The process of locating these errors, and correcting them, took another eight minutes.

The paper-and-pencil method was the slowest of the three methods, requiring 22 minutes to transcribe the open-ended responses and another 28 minutes to transfer the coded responses into SPSS. Part of the time needed was used to create the field definitions in the SPSS spreadsheet, while the rest was spent entering the actual data. Unfortunately, no easy method existed for checking the accuracy of the transcribed work. A spot-check of five respondent's data revealed one (or more) errors in 2 of the 5. This error rate was deemed unacceptable, and the entire SPSS data set was then cross-checked and corrected against the paper originals. The process took another 12 minutes to accomplish.

Only a limited examination was performed of the actual data collected, as the purpose of this study was to examine the methodology used and not the instrument results itself. Comparisons (using one-way analysis of variance and chi-squared statistics) were made, however, on each question across each of three methodologies to insure that no one method experienced a sample too different than any other. In no case were any statistically significant differences found on any item between the three groups. All three methods experienced very equal samples of respondents, even as it concerns the length -- number of words used -- in their open-ended responses.

## Conclusions

The paper-and-pencil methodology was the easiest and fastest to get into the field, although it turned out to be the most time consuming and prone to errors of the three methods when it came to transcribing the data into the computer. The PDA method, on the other hand, was the fastest (and most accurate) of the three methods in moving its data from the field into the computer, although it required a substantial investment of time to learn the software and program the survey. The OMR strategy seemed to split the difference between the other two, requiring only a modest investment of time to set up but a somewhat longer period to transfer data.

In a similar fashion the research assistants favored the paper-and-pencil method over the other two when it came to getting the instrument out into the field quickly. All three were amazed at the speed and accuracy of the PDA on the third stage of the study, and felt that the PDA might have benefits in longer surveys, more complicated instruments, or those involving larger numbers of subjects. The PDA was also the smallest of the three field instruments used, making it the easiest to carry and the least obtrusive for the participants.

The results from this research suggest that a paper-and-pencil technique would be much more appropriate, and faster to implement, when a quick study using a limited number of items needed to be performed on a small sample. The OMR technology will likewise continue to experience for very large samples, and groups of participants that are not contacted in person (such as through the mail). The PDA, however, seems to be well suited to fill a niche where easy researcher mobility, a high degree of data transfer accuracy, and not too large sample is being utilized. Under these circumstances, especially when the researcher is comfortable with the software being used, the PDA is quite impressive with its potential to handle many different kinds of items, responses, and designs.

The Pilot PDA, using the PilotForms software, seems like it would make a fine addition to a field researchers toolbox of techniques. Although not for everyone, a device like this could be used quite effectively for the researcher willing to invest the time to learn how to operate the software. Undoubtably future innovations in hardware and software will continue to improve on the portability, features, and utility of these personal digital assistants. Researchers involved in field studies requiring these capabilities should investigate the potential use of a PDA as one means of reducing their workload while improving data accuracy.

## References

Blodgett, M. (1997, March 17). Palmpilot upgrades try to invade Win CE turf. Computerworld, 31, 43.

Byte Magazine (1996, March). Finally, push-button PDA-to-PC integration. Byte, 21, 40.

Davids, N. (1996a, September). Personal digital assistants: Part 1. Computer, 29, 96-9.

Davids, N. (1996b, November). Personal digital assistants: Part 2. Computer, 29, 100-4.

Foster, C. D. (1995). PDAs and the library without a roof. Journal of Computing in Higher Education, 7(1), 85-93.

Lasky, M. S., & McCracken, H. (1997). Put a PC in your pocket. PC World, 15(5), 153-6, 60, 62, 66, 68.

Marshall, T. (1996, May). Well-connected PDAs. Byte, 21, 103-6.

Pendragon Software Corporation. (1997). PilotForms version 1.1 [computer software]. Buffalo Grove, IL: author.

Saudargas, R. A., & Bunn, R. D. (1989). A handheld computer system for classroom observations. Journal of Special Education Technology, 9(4), 200-06.

Saudargas, R. A., & Zanolli, K. (1990). Momentary time sampling as an estimate of percentage time: A field validation. Journal of Applied Behavior Analysis, 23(4), 533-37.

Thompson, T. (1996, May). Newton reborn. Byte, 21, 123.

U. S. Robotics. (1996). Pilot desktop handbook, Los Altos, CA: U.S. Robotics, Palm Computing Division.

Wayner, P. (1996, July). PDA packs power in your pocket. Byte, 21, 48.

Wise, S. L. (1985). The development and validation of a scale measuring attitudes towards statistics. Educational and Psychological Measurement, 45, 401-5.

Appendix A
Survey of Attitudes About Statistics Courses

**Thank you for participating in this survey of attitudes about statistics courses. This survey will only take a few minutes.**

*[Record today's date and time]*

**Let's begin with some basic questions about you.**

First, what is your gender? Male Female

How old are you? _____ years

What is your ethnicity?
White, non-Hispanic
Black, non-Hispanic
Hispanic
Asian/Pacific Islander
Native American/Alaskan
Other
No Answer

What is your academic major? _____

Have you ever taken a statistics course before? Yes No

*[If NO, skip the next three questions]*

**The next questions are about the statistics course(s) you have taken.**

How many statistics courses have you taken? _____

On a scale of 1 to 5, with 1 being worst and 5 being best, how much did you enjoy these courses overall? 1 2 3 4 5

Would you recommend any of the statistics courses you took to another student? Yes No

*[continue on the back]*

**The next part of the survey asks your opinion about statistics courses in general. Answer these next questions on a 1 to 5 scale, with a 1 being "Strongly Disagree" and a 5 being "Strongly Agree". Ready?**

| | |
|---|---|
| The thought of being enrolled in a statistics course makes be nervous. | 1 2 3 4 5 |
| Statistics seems very mysterious to me. | 1 2 3 4 5 |
| I see being enrolled in a statistics course as a very unpleasant experience. | 1 2 3 4 5 |
| I would like to continue my statistical training in an advanced course. | 1 2 3 4 5 |
| I wish that I could have avoided taking my statistical course. | 1 2 3 4 5 |
| I get upset at the thought of enrolling in another statistics course. | 1 2 3 4 5 |
| I feel intimidated when I have to deal with mathematical formulas. | 1 2 3 4 5 |
| Statistics is too complicated for me to use effectively. | 1 2 3 4 5 |

Would you share with me any other thoughts you might have about statistics courses?

*[Record today's date and time]*

**Thank you very much for participating. Have a nice day!**